National Instruments
NI-9219 A/D Converter (ADC) Interface
User Guide

Scion Instruments
1 Bain Square
Livingston, EH547DQ
United Kingdom

©Scion Instruments 2017
Publication Number BR501590
Revision C

Contents

Introduction 3
NI-DAQMX Software Installation 4
Configuring the NI-9184 Ethernet Chassis Hostname and IP Address using the NI-DAQMX Software 6
Connecting the NI-9219 ADC Module 10
Connecting the NI-9401 TTL I/O Module as the Start In device for the NI-9219 ADC 11
Installing the National Instruments Control Drivers and Configuring a System in Configuration Manager 13
Creating a Method in CompassCDS 17
Adding the NI-9481 Relay Module as an additional module in the NI-9184 Chassis 19
NI Modules - Technical Specifications 22
  NI-9184 Chassis 22
  NI-9219 ADC Module 22
  NI-9401 TTL I/O Module 23

Introduction

When analog data acquisition from GC/LC instruments into CompassCDS is a requirement, this can be done using the National Instruments 9219 ADC Module installed together with the NI-9401 TTL I/O module in the NI-9184 4 slot Ethernet chassis. These modules are shown below. It is also possible to add the NI-9841 Relay module as an optional unit when contact closure relay functionality is required.

NI-9184 4-slot Ethernet Chassis

NI-9219 4-Channel Analog to Digital converter module

NI-9401 TTL I/O module

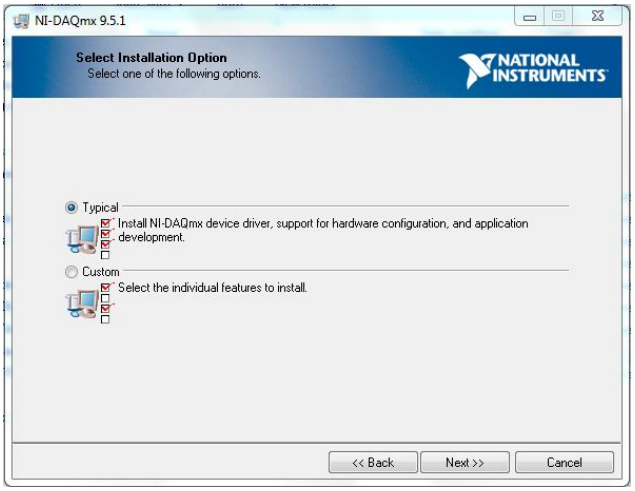
NI-9924 Terminal Connector

NI-9481 4-Channel Relay module (Optional)

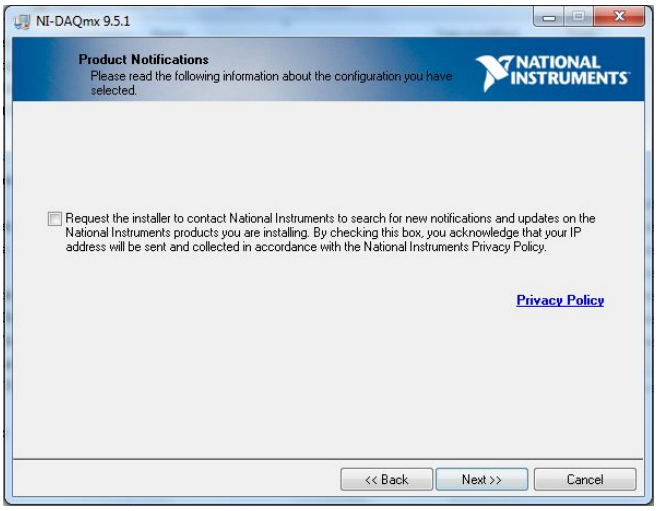
NI-DAQMX Software Installation

The NI-DAQMX software supplied with the NI-9184 Chassis is required to be installed in order to configure the NI-Modules as described in this user guide. Configuration includes assigning a unique hostname, a static IP address, a subnet mask and if required a Gateway IP. This software is installed from the vendor supplied NI-DAQMX DVD as follows:

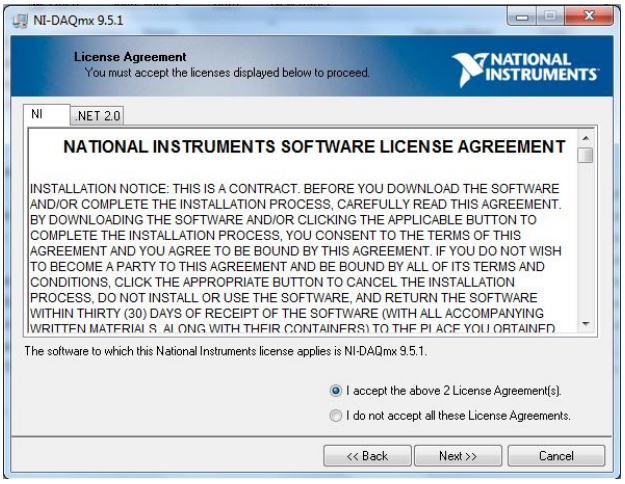
1. Select the Typical installation option and click Next.



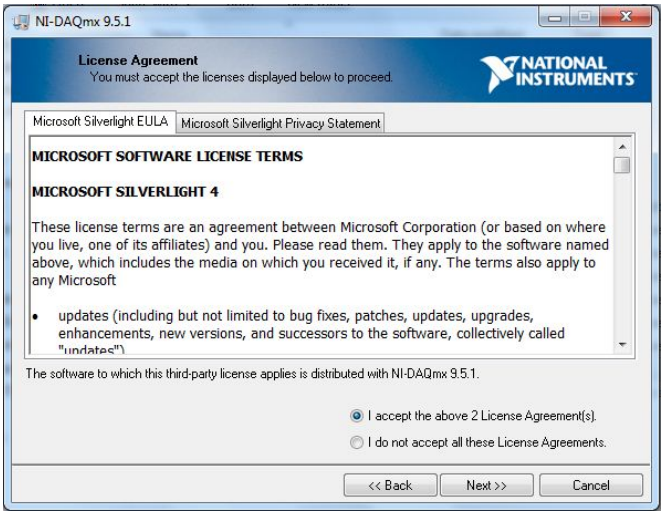
2. Uncheck the “Request the installer to contact National Instruments” option and click Next.


NI-DAQmx 9.5.1
Product Notifications
Please read the following information about the configuration you have selected.
NATIONAL INSTRUMENTS
Request the installer to contact National Instruments to search for new notifications and updates on the National Instruments products you are installing. By checking this box, you acknowledge that your IP address will be sent and collected in accordance with the National Instruments Privacy Policy.
Privacy Policy
<< Back
Next >>
Cancel

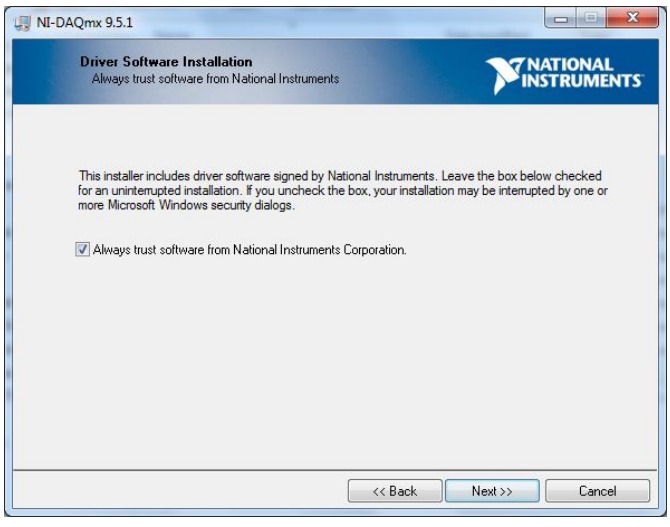
3. Accept the National Instruments license agreements and click Next.


NI-DAQmx 9.5.1
License Agreement
You must accept the licenses displayed below to proceed.
NATIONAL INSTRUMENTS
NI
.NET 2.0
NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEMENT
INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE INSTALLATION PROCESS, DO NOT INSTALL OR USE THE SOFTWARE, AND RETURN THE SOFTWARE WITHIN THIRTY (30) DAYS OF RECEIPT OF THE SOFTWARE (WITH ALL ACCOMPANYING
The software to which this National Instruments license applies is NI-DAQmx 9.5.1.
I accept the above 2 License Agreement(s).
I do not accept all these License Agreements.
<< Back
Next >>
Cancel

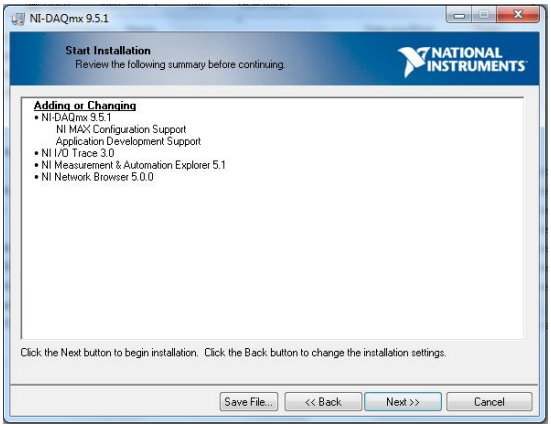
4. Accept the Microsoft software licenses and click Next.

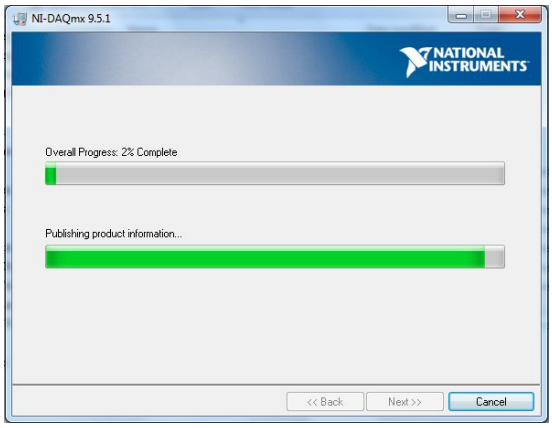

NI-DAQmx 9.5.1
License Agreement
You must accept the licenses displayed below to proceed.
NATIONAL INSTRUMENTS
Microsoft Silverlight EULA
Microsoft Silverlight Privacy Statement
MICROSOFT SOFTWARE LICENSE TERMS
MICROSOFT SILVERLIGHT 4
These license terms are an agreement between Microsoft Corporation (or based on where you live, one of its affiliates) and you. Please read them. They apply to the software named above, which includes the media on which you received it, if any. The terms also apply to any Microsoft
updates (including but not limited to bug fixes, patches, updates, upgrades, enhancements, new versions, and successors to the software, collectively called
The software to which this third-party license applies is distributed with NI-DAQmx 9.5.1.
I accept the above 2 License Agreement(s).
I do not accept all these License Agreements.
<< Back
Next >>
Cancel

5. Check the “Always trust software from National Instruments Corporation” option and click Next.

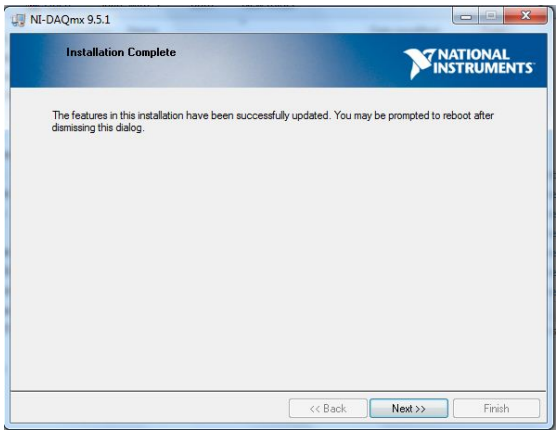

NI-DAQmx 9.5.1
Driver Software Installation
Always trust software from National Instruments
NATIONAL INSTRUMENTS
This installer includes driver software signed by National Instruments. Leave the box below checked for an uninterrupted installation. If you uncheck the box, your installation may be interrupted by one or more Microsoft Windows security dialogs.
Always trust software from National Instruments Corporation.
<< Back
Next >>
Cancel

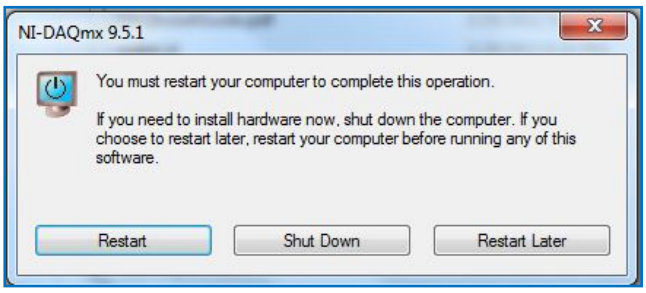
6. Click the Next button to start the installation. The installation of this software can take 20-30 minutes. The progress bar (shown below) indicates the state of the installation.


NI-DAQmx 9.5.1
Start Installation
Review the following summary before continuing.
NATIONAL INSTRUMENTS
Adding or Changing
• NI-DAQmx 9.5.1
NI MAX Configuration Support
Application Development Support
• NI I/O Trace 3.0
• NI Measurement & Automation Explorer 5.1
• NI Network Browser 5.0.0
Click the Next button to begin installation. Click the Back button to change the installation settings.
Save File...
<< Back
Next >>
Cancel



7. When the message indicating that the installation has successfully completed, click the Next button and Restart the computer as instructed.


NI-DAQmx 9.5.1
Installation Complete
NATIONAL INSTRUMENTS
The features in this installation have been successfully updated. You may be prompted to reboot after dismissing this dialog.
<< Back
Next >>
Finish

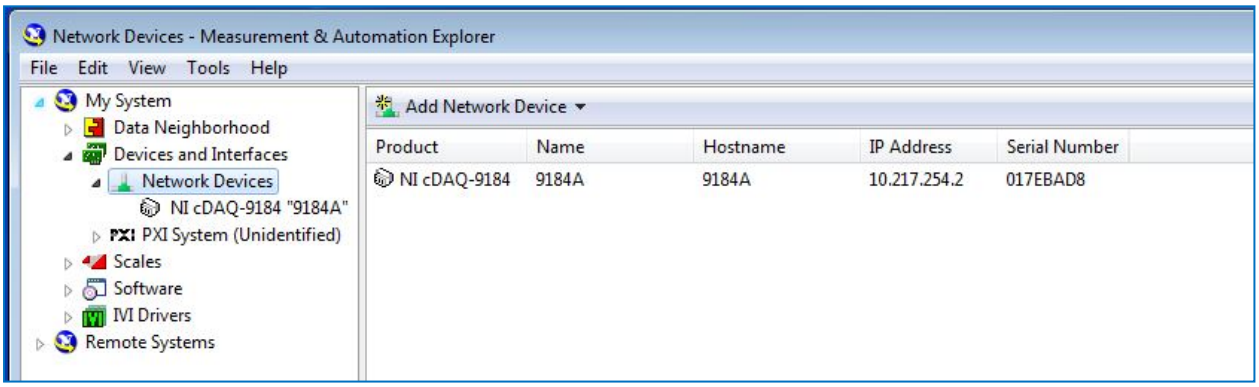

NI-DAQmx 9.5.1
You must restart your computer to complete this operation.
If you need to install hardware now, shut down the computer. If you choose to restart later, restart your computer before running any of this software.
Restart
Shut Down
Restart Later

8. Once the computer reboots, NI-DAQMX icon should be visible on the desktop

Configuring the NI-9184 Ethernet Chassis Hostname and IP Address using the NI-DAQMX Software

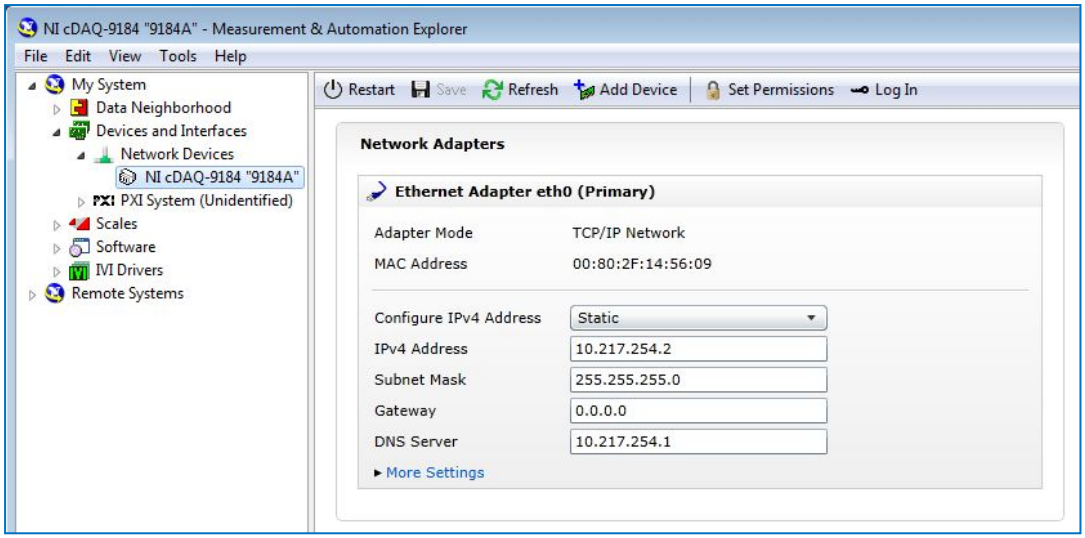
To configure a NI-9184 4-slot chassis on a CompassCDS acquisition and control client computer, the CompassCDS National Instruments control drivers should have already been installed on this computer and the NI-9184 chassis (with the NI-9219 ADC and NI-9401 TTL I/O module installed as shown in the figure below), powered on and connected either directly to the computer via an Ethernet crossover cable or indirectly via an Ethernet switch or router.

The previously installed NI-DAQMX software can then be launched from the Windows desktop and *Devices and Interfaces* selected by clicking on this option. Select the *Network Devices* option by clicking on it as shown below.



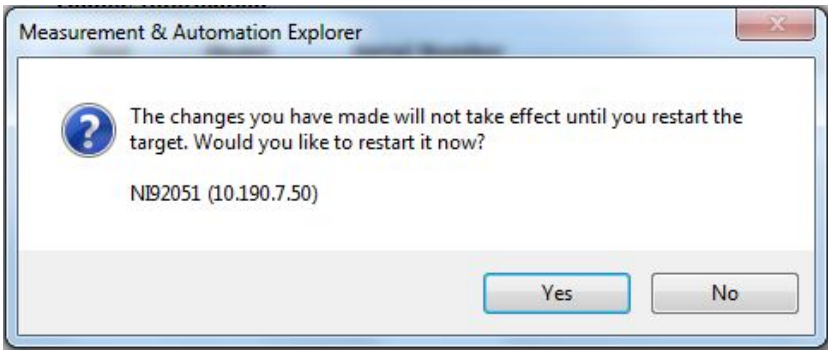
A list of the available NI-9184 chassis similar to the one shown above will appear. Clicking on the network device in the list will bring up the default Hostname and IP address as shown below. The System state will appear as *Disconnected* and the NI-9184 unit will be *Unavailable*.

Very Important: To modify the chassis Hostname, IP address, Subnet Mask and Gateway, it may be necessary to temporarily change the host computer IP and Subnet Mask to a range that matches that shown initially by the NI-9184 chassis. Once this has been done, close the NI-DAQMX software and re-open it, select *Devices and Interfaces* then *Network Devices* and click on the *NI-cDAQ-9184* module shown under Network Devices. Select the Network devices tab and editable Network Adapter fields (shown below) will be visible. The IPV4 Address should be configured as Static. Insert the IP address to be used for this device to be able to communicate with the CompassCDS acquisition client, the associated Subnet Mask, and if required, Gateway and DNS server address. Click the *Save* Icon.

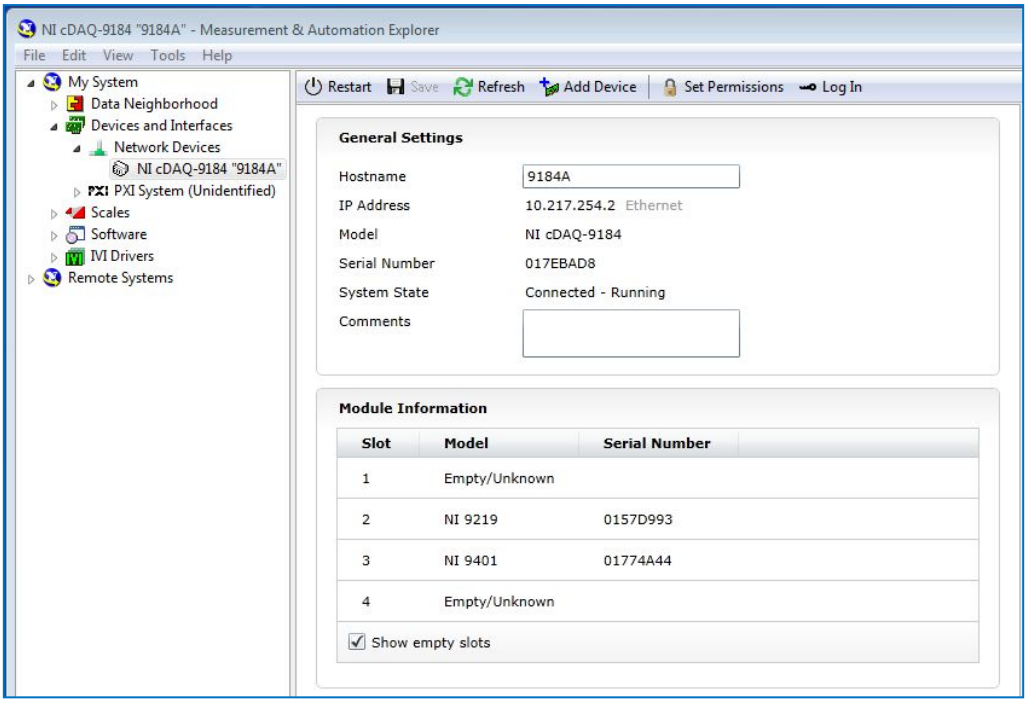


Select the General Settings tab and enter a unique Hostname. This Hostname will be required when configuring the 9184 chassis as part of a system in CompassCDS configuration manager. The new IP, Subnet Mask and Gateway addresses should be visible. Click the *Save* icon.

The following message will appear. Select Yes.

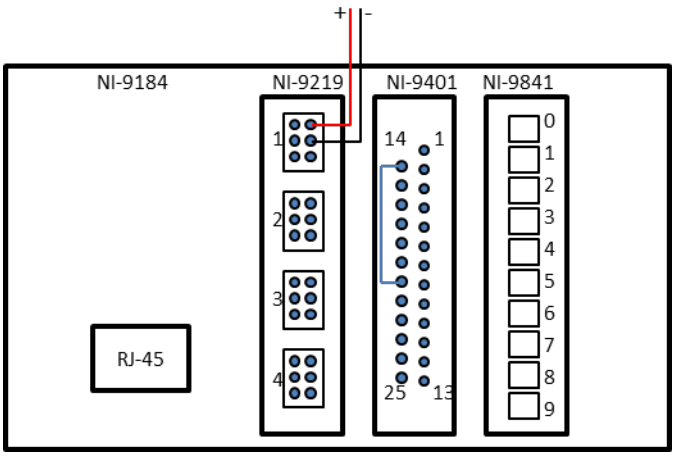

Measurement & Automation Explorer
The changes you have made will not take effect until you restart the target. Would you like to restart it now?
NI92051 (10.190.7.50)
Yes
No

Very Important: **It will now be necessary to modify the IP address and Subnet mask of the host computer back to the original settings being used for CompassCDS.** Once this has been done, re-launch the cDAQMX software and select Devices and Interfaces, Network Devices and the following screen with the modified Hostname and IP should appear and the System State should be *Running*. The installed 9219 A/D, 9401 TTL I/O and, if installed, the 9481 Relay module, should be listed (as shown below). This indicates a correctly configured NI-9184 chassis and this module can now be used to make up part of system in CompassCDS Configuration Manager.

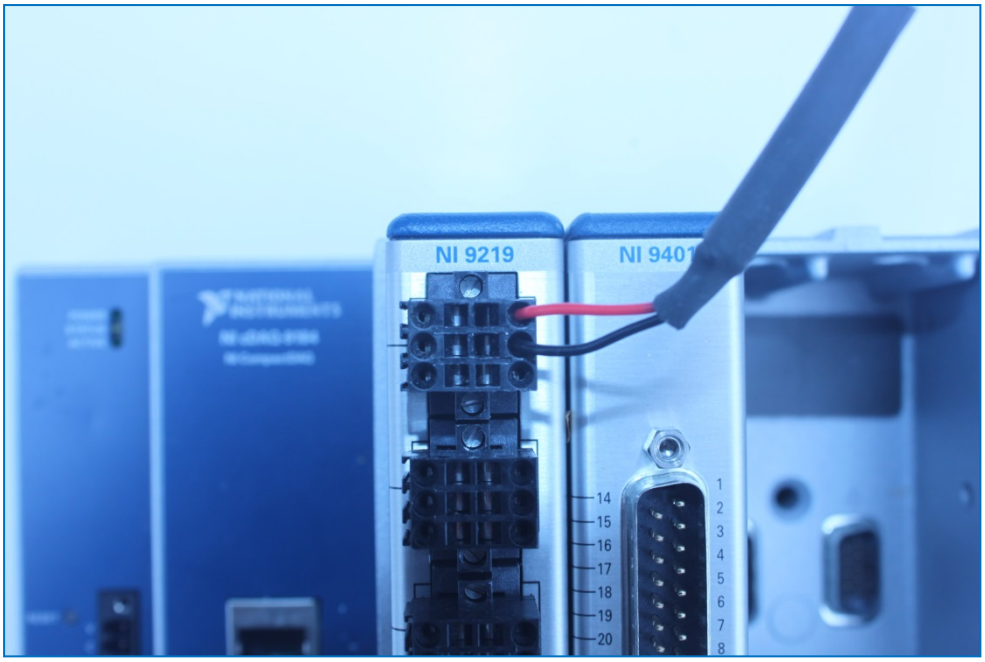

NI cDAQ-9184 "9184A" - Measurement & Automation Explorer
File Edit View Tools Help
My System
Data Neighborhood
Devices and Interfaces
Network Devices
NI cDAQ-9184 "9184A"
PXI System (Unidentified)
Scales
Software
IVI Drivers
Remote Systems
Restart Save Refresh Add Device Set Permissions Log In
General Settings
Hostname 9184A
IP Address 10.217.254.2 Ethernet
Model NI cDAQ-9184
Serial Number 017EBAD8
System State Connected - Running
Comments
Module Information
Slot Model Serial Number
1 Empty/Unknown
2 NI 9219 0157D993
3 NI 9401 01774A44
4 Empty/Unknown
Show empty slots

Connecting the NI-9219 ADC Module

The NI-9219 ADC module comprises 4x6 port connectors as shown in the diagram below. In order to connect a GC or LC detector analog output to Channel 1 of the NI-9129, the positive and negative outputs should be connected as shown below. If two detectors from the same instrument are to be connected, the same ports in the second connector should be used. The tinned ends of the cables are simply pushed into the ports after a small screwdriver (supplied with the NI-9219) has been inserted into the slot next to each port to open the connector.



Analog outputs from GC/LC detectors should be connected as shown below.



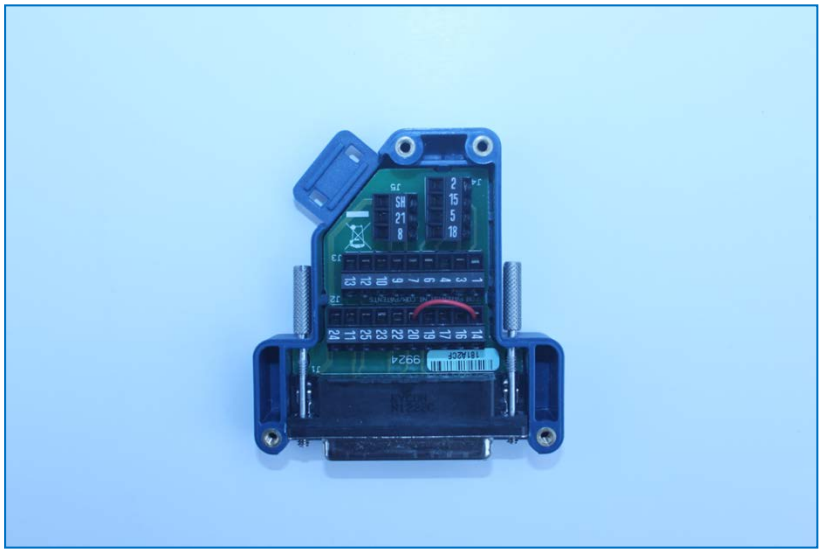
Connecting the NI-9401 TTL I/O Module as the Start In device for the NI-9219 ADC

The NI-9401 has a 25-pin DSUB connector terminal that provides connections for eight digital input/output channels. Each channel has a Digital I/O (DIO) pin to which can be connect a digital input or output device. The eight DIO channels are internally referenced to COM, so any of the nine COM lines can be used as a reference for the external signal. The DIO channels are grouped into two ports, one containing channels 0, 1, 2, and 3 (Inputs), and one containing channels 4, 5, 6, and 7 (Outputs). It is possible to independently configure each digital port for input or output however all four channels in the port must share the same line direction. Each channel also has a pull-down resistor and includes overvoltage, overcurrent, and short-circuit protection. Input and Outputs are configured as follows on the Terminal Connector.

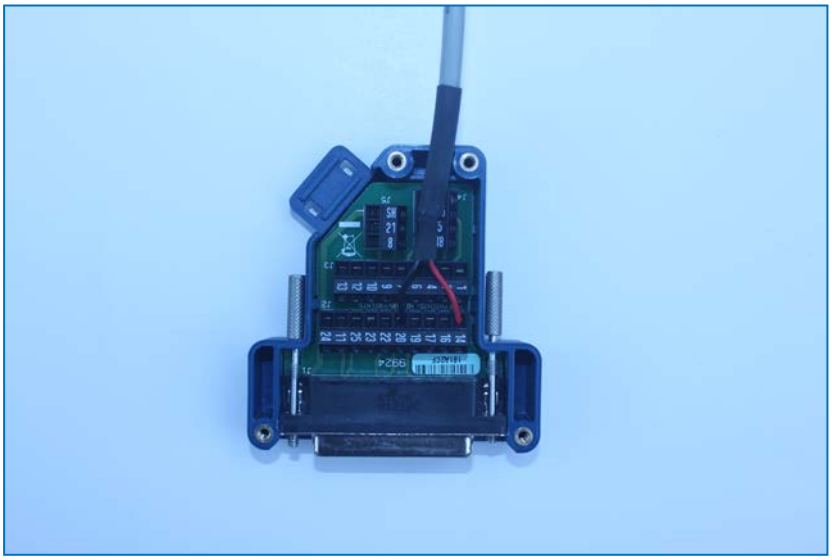
Terminals	Channel	Terminals	Channel
14 & 1	Input 1	20 & 7	Output 1
16 & 3	Input 2	22 & 9	Output 2
17 & 4	Input 3	23 & 10	Output 3
19 & 6	Input 4	25 & 12	Output 4

As the NI-9219 requires an energized start input signal (0.2-5.0 VDC) in order to initiate data acquisition, the NI-9401 module needs to be wired as follows:

1. For immediate starting of data acquisition on NI-9219 Channels 1 – 4, the NI-9401 output terminal 20 should be directly connected to input terminal 14 as shown below.

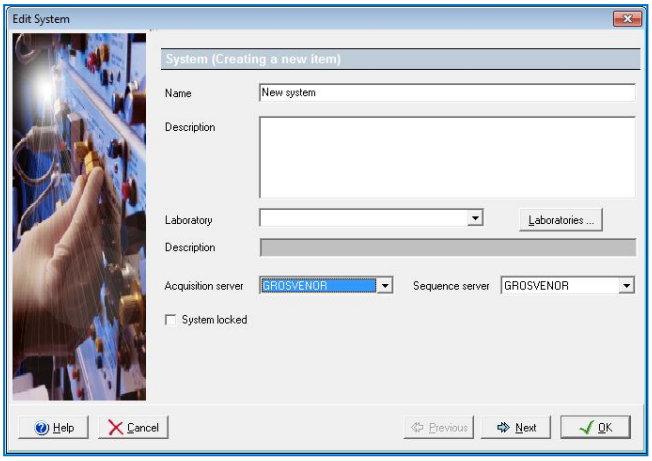


2. For starting of a system from the CompassCDS “Waiting for Injection” phase, i.e., where the start signal will come from either a contact closure or TTL device, the NI-9401 output terminal 20 and input terminal 14 should be connected as shown below.

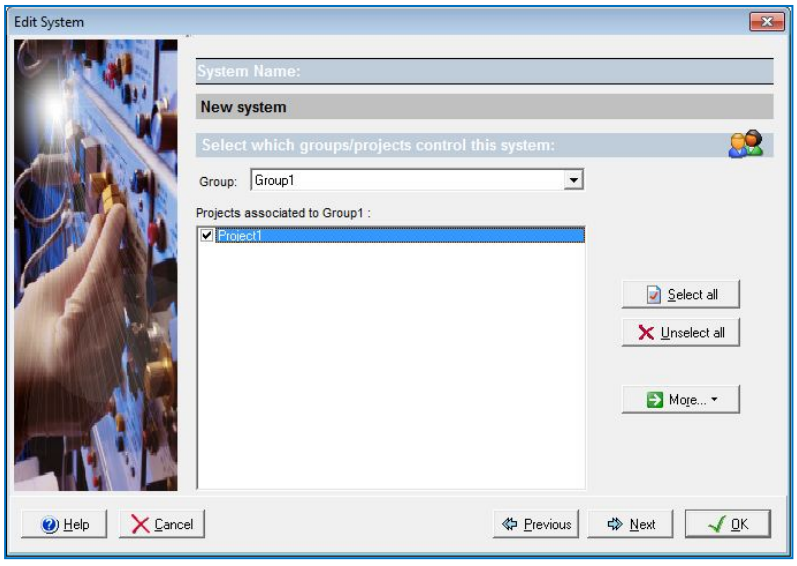


Installing the National Instruments Control Drivers and Configuring a System in Configuration Manager

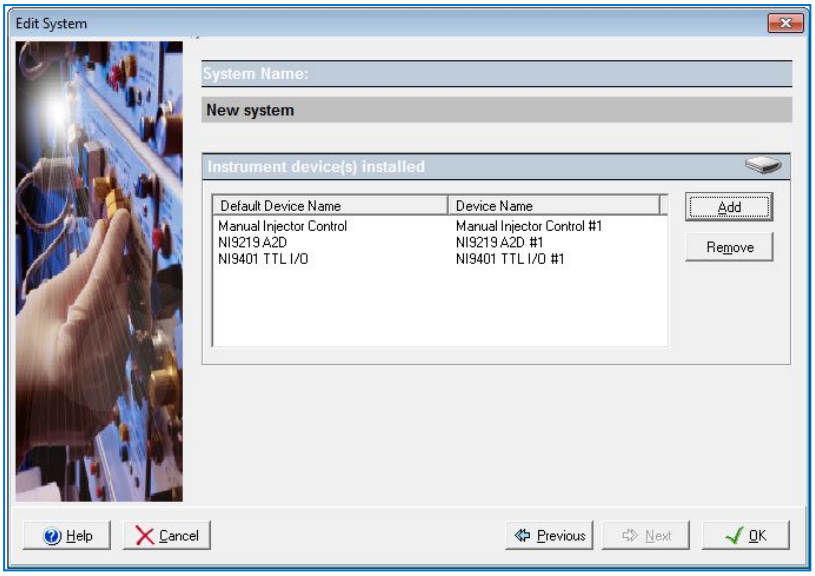
The National Instruments Control drivers for the NI-9219 module can be installed directly from the CompassCDS DVD. These drivers are located in the Drivers\SCION NI_CDAQ folder on the CompassCDS DVD. To install these drivers, run the setup.exe. Once the drivers have been installed, log into CompassCDS Configuration Manager and create a new system by selecting the Systems icon, right clicking in the Systems panel and selecting New.



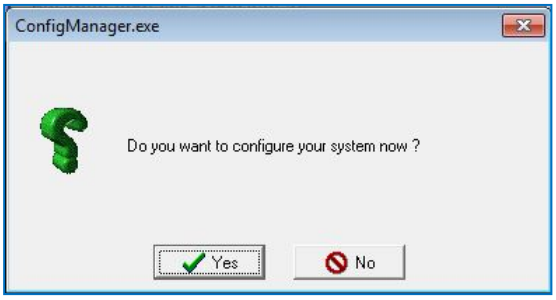
The system must be given a name (in this example New System) and have an Acquisition and a Sequence server designated as shown in the figure above. Clicking Next will bring up the Group and Project association panel. The System should be associated with at least one Group and one Project but this can also be done later via the Associations icon. Click Next to bring up the Instrument device(s) installed panel.



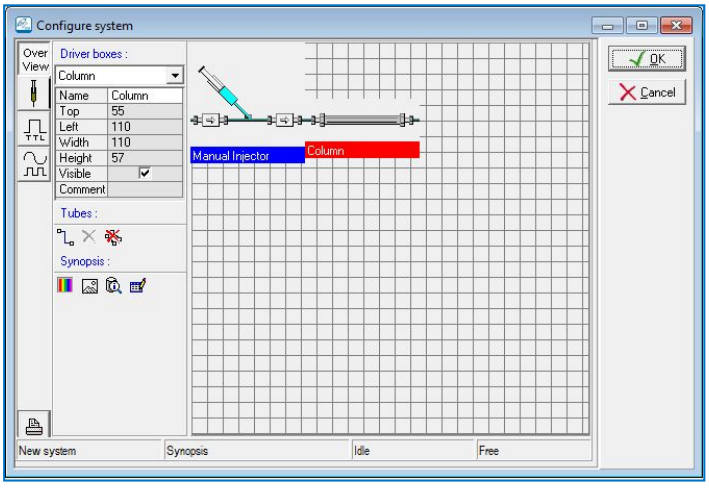
The device control drivers required for analog data acquisition with the NI-9219 module are shown in the figure below. These can be selected by clicking the Add button.



Once the three device drivers (Manual Injector, NI-9219 and NI-9401) have been selected, click the OK button and the following prompt will appear.

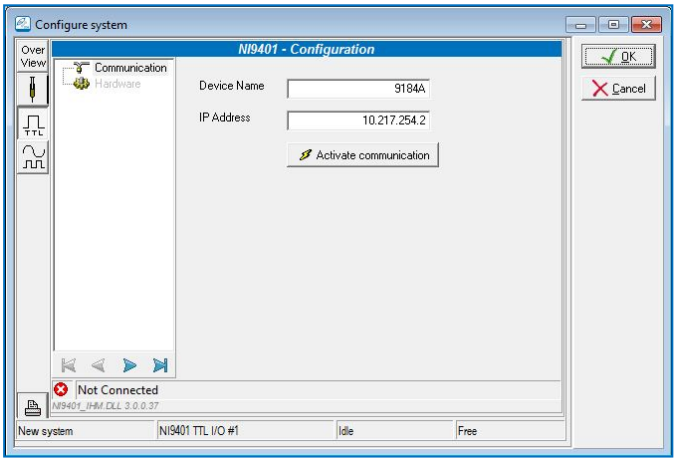


Click the Yes button and the following configuration screen (below) will appear. Select the NI-9401 by clicking on the TTL icon on the left.

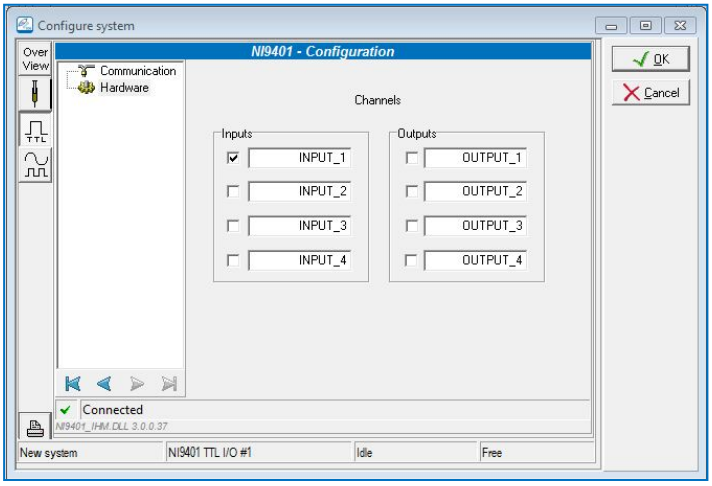


Select the Communication panel by clicking on Communication in the panel and enter the NI-9184 Chassis Hostname (originally configured by using the NI-DAQMX software) in the Device Name panel and the IP (originally configured by using the NN-DAQMX software) in the IP Address panel.

Important: Before clicking the Activate communication button, make sure the Communication (above Hardware) is highlighted in blue, by clicking on it. Now Click the Activate Communication button. Messages indicating that NI DAQ module drivers are loading will appear in the bottom right of the screen.

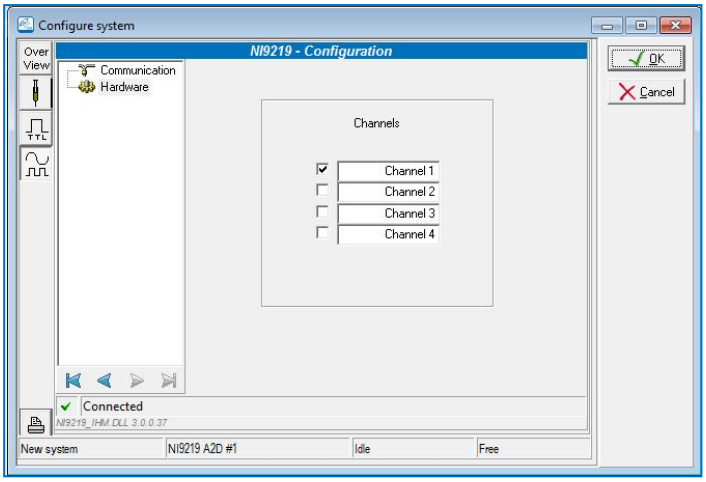


Once the drivers have completed loading, the NI-9401 Hardware option will become active and clicking on this will bring up the Input/Output Channel dialog. When the NI-9401 module is being used as the start device for the NI-9219, only the first input channel needs to be checked and all other channels must be left unchecked as shown below. The channel can be renamed if required.

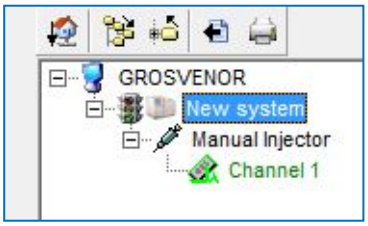


Repeat the Hostname and IP assignment procedure for the NI-9219 module.

Important: Before clicking the Activate communication button, make sure the Communication (above Hardware) is highlighted in blue, by clicking on it. When the Hardware option becomes active, Select Channel 1 as shown below and rename it if required. Click OK.

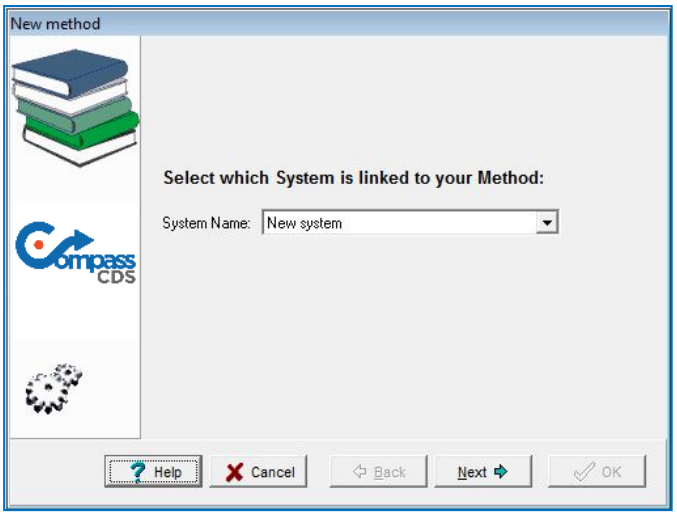


The configured system will be visible in the Stations/Systems panel in configuration manager (shown below). Select the system by clicking on the name and then right click to Stop the system. Right click again and Start the system.

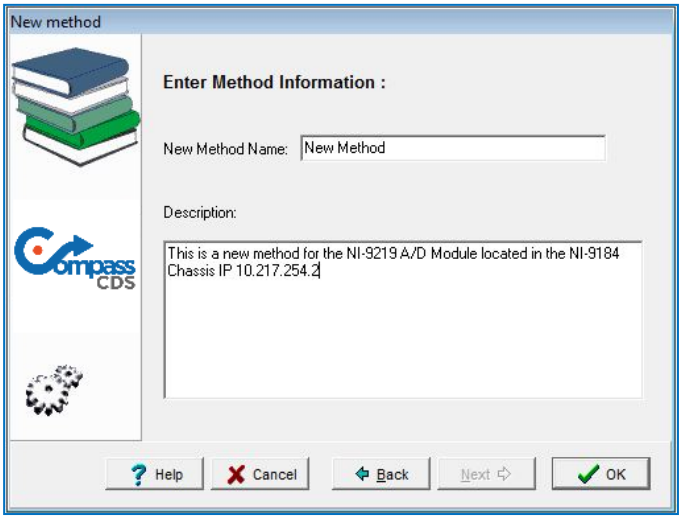


Creating a Method in CompassCDS

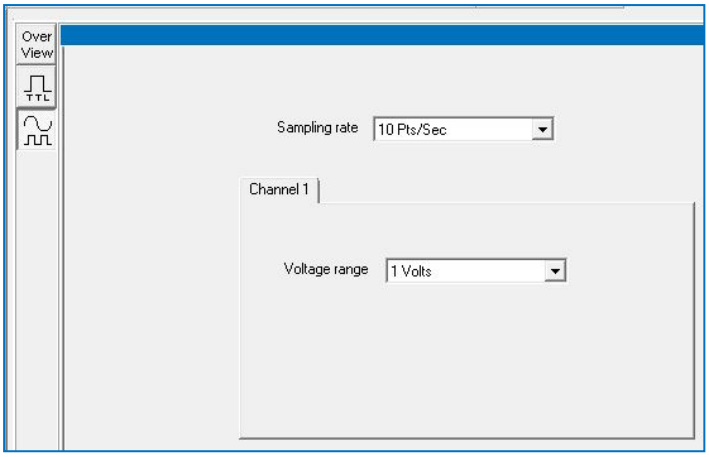
Log into CompassCDS and select File, New, New Method. The user will be prompted to select the System with which the method will be associated (in this example New system) as shown below. Click Next



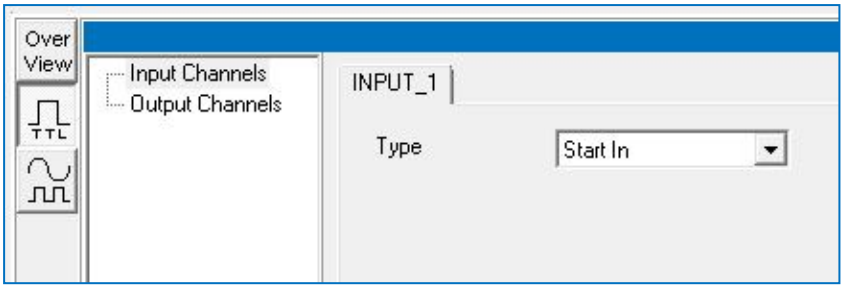
A method name and, if desired, a description of the method can be added as shown below. Clicking OK will bring up the method in the CompassCDS Data view.



Clicking on the Control section of the method tree brings up the method configuration panels for the NI-9219 and NI-9401 modules. The data sampling rate (1-100 points/second) and the voltage range (± 1, 2.5, 10V) can be selected here.



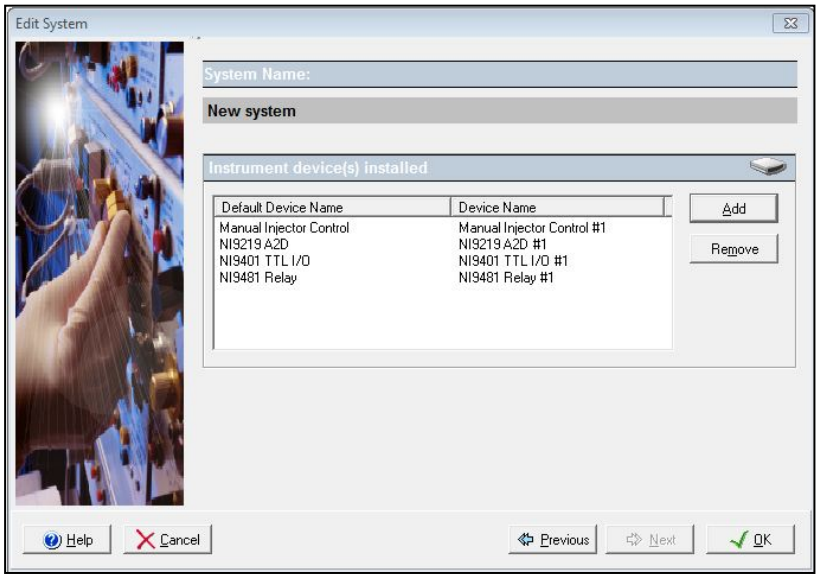
The NI-9401 module must have the input Type set to Start In as shown below.



Save and close the method once all the other relevant sections (acquisition, report style, etc.) in the method tree have been completed.

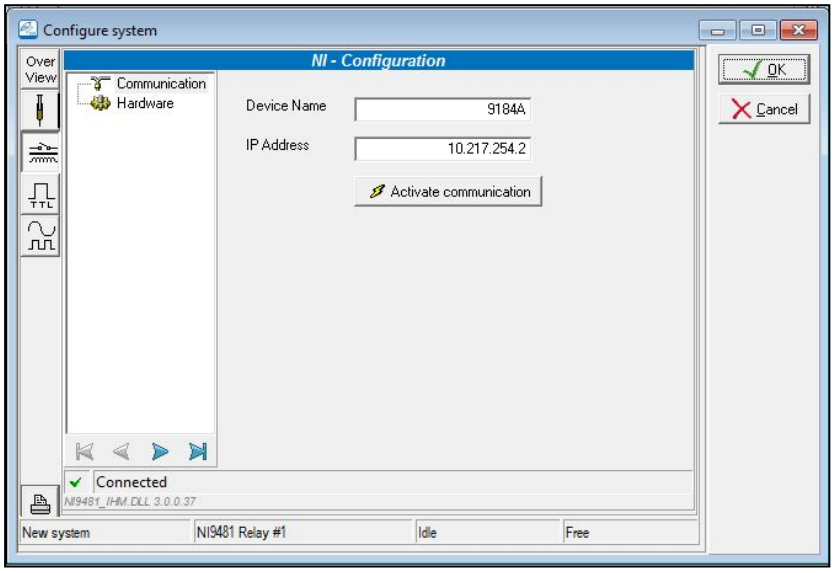
Adding the NI-9481 Relay Module as an additional module in the NI-9184 Chassis

Due to the modular nature of the NI-cDAQ devices, it is possible to add the NI-9481 contact closure relay module to the NI-9184 chassis if relay functionality is required in addition to analog data acquisition. The NI-9481 module should be inserted into the NI-9184 chassis as shown below. The NI-DAQMX software will be required to be used to assign the NI-9481 relay module a unique hostname and IP address as described previously in this guide. Once the NI-9481 module is being recognized with the correct hostname and IP address, it can be added to an existing System using Configuration Manager. The NI-9481 Relay device driver needs to be added to the system configuration as shown below.

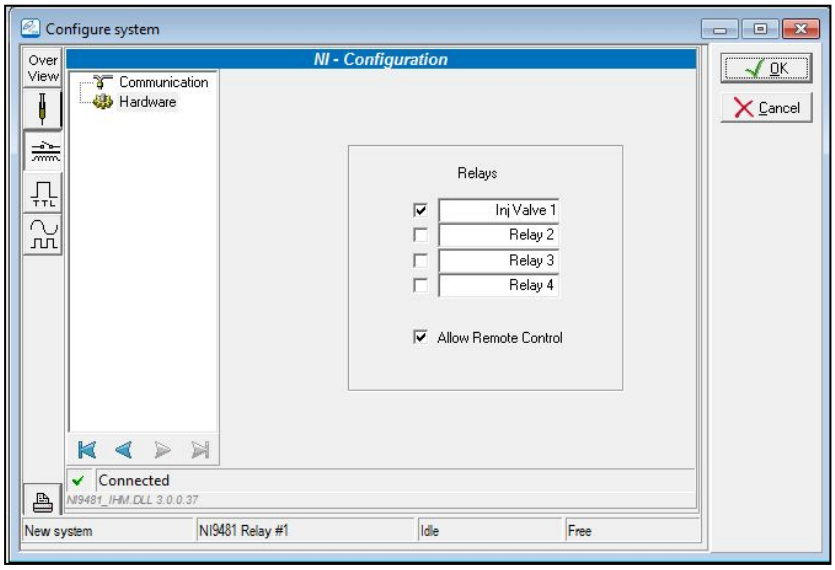


Select the Communication panel by clicking on Communication in the panel and enter the NI-9194 Chassis Hostname (originally configured by using the NI-DAQMX software) in the Device Name panel and the IP (originally configured by using the NN-DAQMX software) in the IP Address panel as shown below.

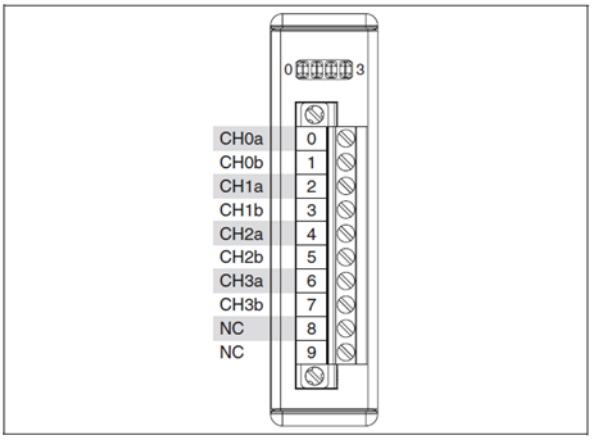
Important: **Before clicking the Activate communication button, make sure the Communication (above Hardware) is highlighted in blue, by clicking on it**. Now Click the Activate Communication button. Messages indicating that NI DAQ module drivers are loading, will appear in the bottom right of the screen.

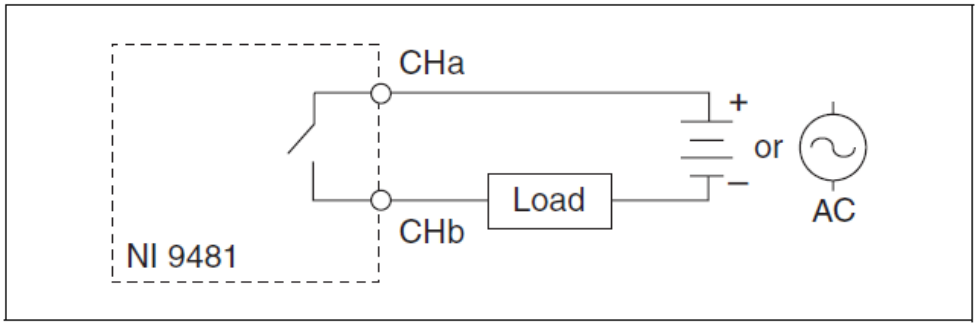


When the Hardware option becomes active, select the relay(s) to be used (see below) and also check the Allow Remote Control option if manual control of the relays from the CompassCDS system status screen is required. Click OK and stop and start the system as before.



When connecting a load to the NI-9481, connect the positive lead of the load to either the CHa or the CHb terminal, and the ground of the load to one of the leads of the power supply. Connect the remaining CHa or CHb terminal to the other lead of the power supply. An example of this type of configuration is illustrated below.


0
3
CH0a
CH0b
CH1a
CH1b
CH2a
CH2b
CH3a
CH3b
NC
NC
0
1
2
3
4
5
6
7
8
9


CHa
CHb
NI 9481
Load
+
–
or
AC

NI Modules - Technical Specifications

NI-9184 Chassis

Power Requirements	15 W
Number of Chassis Slots	4
Total Available Power	15 W
Input Voltage Range	9 V - 30 V
Built-In Trigger	No
A/D Resolution	32 bits
Network protocols	TCP/IP, UDP
Network ports used	HTTP:80 (configuration only),
	TCP:3580;
	UDP:5353 (configuration only),
	TCP:5353 (configuration only);
	TCP:31415;
	UDP:7865 (configuration only),
	UDP:8473 (configuration only)
Network IP configuration	DHCP + Link-Local, DHCP, Static, Link-Local Network interface
NI cDAQ-9184	100 Base-TX, full-duplex
	100 Base-TX, half-duplex
	10 Base-T, full-duplex
	10 Base-T, half-duple
Communication rates	
NI cDAQ-9184	10/100 Mbps, auto-negotiated
Maximum cabling distance	100 m/segment
Voltage input range	9 to 30 V
Weight (unloaded)	Approx. 470 g (16.6 oz)
Dimensions (unloaded)	194.0 × 88.7 × 33.6 mm (7.64 × 3.49 × 1.32 in.)
Operating Temperature (IEC-60068-2-1 and IEC-60068-2-2)	
NI cDAQ-9184.	0 to 55 °C
Ingress protection	IP 30
Operating Humidity (IEC-60068-2-56)	10 to 90% RH, noncondensing

This module meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use: IEC 61010-1, EN 61010-1, UL 61010-1, CSA 61010-1

NI-9219 ADC Module

Differential Input Channels	4
Resolution	24 bits
Sample Rate	100 pts/s
Maximum Voltage Range	-60 V - 60 V
Minimum Voltage Range	-0.125 V - 0.125 V
Excitation Voltage	2.5 V
Length	9 cm
Width	2.3 cm

NI-9401 TTL I/O Module

Number of channels	8 DIO channels
Default power-on line direction	Input
Input/output type	TTL, single-ended
Input Voltage	5.25 V max
High, VIH	2 V min
Low, VIL	0.8 V max
Output	
Output Voltage High, VOH	5.25 V max
Output Voltage Low	
Sinking 100 µA	0.1 V max
Sinking 2 mA	0.4 V max
Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	–40 to 70 °C
Operating humidity (IEC 60068-2-56)	10 to 90% RH, noncondensing

Safety Standards **-** This module is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use: IEC 61010-1, EN 61010-1, UL 61010-1, CSA 61010-1